Guidance and Control for Entry Vehicles with Deployable Hypersonic Decelerators

Completed Technology Project (2011 - 2015)

Project Introduction

Entry, descent, and landing (EDL) missions to date have mostly relied on technology developed in the 1960s and 70s. Future EDL missions of interest at Earth, Mars, Venus, Titan, and the outer planets will require a significant increase in the performance capabilities of EDL systems. This increase in capability can only be achieved through the development of new EDL technologies, such as deployable hypersonic decelerators. As stated in NASA's draft Space Technology Roadmap, deployable hypersonic decelerators (DHDs) have the potential to revolutionize EDL systems, enabling NASA's next generation of exploration missions. However, significant feasibility questions remain about guidance and control systems for DHD vehicles. While NASA has embarked on a substantial inflatable DHD technology maturation effort over the past several years, very little development work has been completed for rigid deployable systems, and only limited work has been completed to date in the area of guidance and control for DHDs. Open guidance and control questions center around whether DHD vehicles possess adequate trajectory control authority to achieve mission objectives, such as precision landing, when high-altitude atmospheric variability, realistic flight control actuation systems, and FSI effects are included. At the EDL system level, realistic DHD vehicle performance capability has not yet been clearly determined. The proposed research revolves around two coupled areas of design and analysis: system-level mission design and performance analysis and subsystem-level guidance and control design and analysis. Numeric simulation, uncertainty analysis, and trade studies will be conducted in both areas in parallel to answer fundamental questions about the feasibility of DHD entry systems. Specifically, this research effort is expected to characterize the impact of DHDs on guidance and control subsystem design, develop preliminary DHD guidance and control system options and algorithms, determine realistic expectations for DHD vehicle performance, and identify additional applications for DHD vehicles beyond high-mass Mars missions.

Anticipated Benefits

Numeric simulation, uncertainty analysis, and trade studies will be conducted in both areas in parallel to answer fundamental questions about the feasibility of DHD entry systems. Specifically, this research effort is expected to characterize the impact of DHDs on guidance and control subsystem design, develop preliminary DHD guidance and control system options and algorithms, determine realistic expectations for DHD vehicle performance, and identify additional applications for DHD vehicles beyond high-mass Mars missions.

Project Image Guidance and Control for Entry Vehicles with Deployable Hypersonic Decelerators

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Space Technology Research Grants

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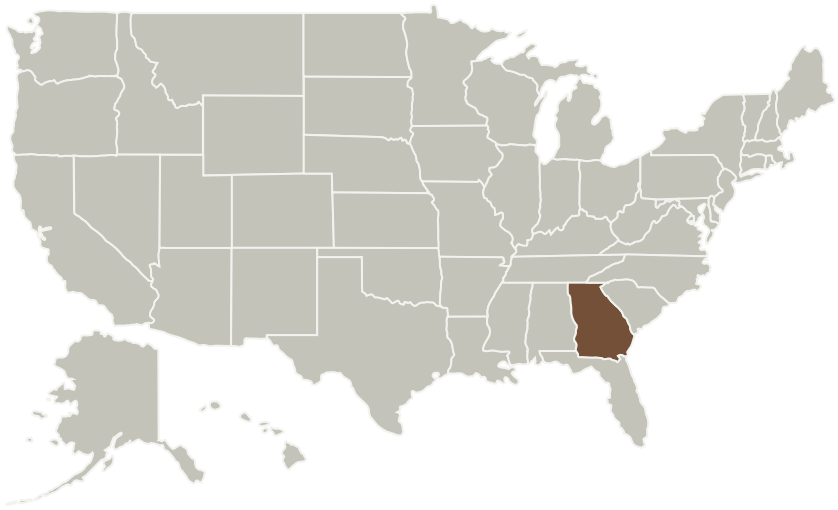
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Georgia Institute of Technology-Main Campus(GA Tech)	Supporting Organization	Academia	Atlanta, Georgia

Primary U.S. Work Locations
Georgia

Project Management

Program Director:
Claudia M Meyer

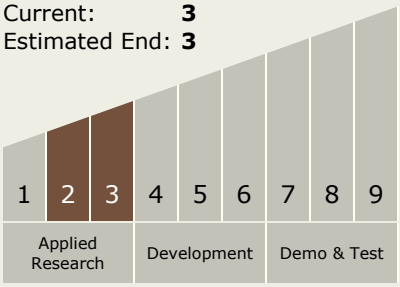
Program Manager:
Hung D Nguyen

Principal Investigator:
Robert D Braun

Co-Investigator:
Zachary R Putnam

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.1 Aeroassist and Atmospheric Entry
    - TX09.1.2 Hypersonic Decelerators

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Images

4207-1363184897644.jpg
Project Image Guidance and Control for Entry Vehicles with Deployable Hypersonic Decelerators
(https://techport.nasa.gov/image/1768)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html